

Applicants apologize to the Commissioner, the Office and the Examiner for submitting a non-compliant amendment and believe that this response to the notice places the amendment originally submitted on 27 May 2003 in compliance.

In response to the Notice of Non-Compliance, mailed on 18 August 2003, please continue to amend the above identified application as follows:

IN THE SPECIFICATION

Please replace the paragraph beginning at line 21 page 3 with the following rewritten paragraph:

a₁ -- The two parts of the direction controller can be configured in a number of different ways. Preferably, the two parts are located on different sides of the central plane. A particularly preferable arrangement is achieved when both of the two parts are capable of applying a independent force to the mandrel. For example, the two parts may be located on either side of the central plane of the housing. For example, both parts may comprise eccentric sleeves. --

Please replace the paragraph beginning at line 1 page 4 with the following rewritten paragraph:

a₂ -- In an alternative configuration, only one part is capable of applying a radial force to the mandrel, the other part only being capable of applying a symmetric force about the mandrel. For example, one part may be an eccentric sleeve and the other may be a concentric sleeve. If the arrangement is envisaged where a concentric sleeve is located on one side of the central plane and an eccentric sleeve is located on the other, then it is possible to form a so-called "point the bit" arrangement. The eccentric sleeve may be located either above or below the central plane of the housing. Two eccentric sleeves oriented at 180° to each other about the mandrel can also achieve this effect. --

Please replace the paragraph beginning at line 4 page 9 with the following rewritten paragraph:

23 -- The apparatus may further comprise a plurality of stabiliser shoes. These stabiliser shoes may be circumferentially offset by a predetermined amount in relation to the weight of the housing. More preferably, the apparatus comprises two stabiliser shoes. The stabiliser shoes which may be blades, wedges etc. extend radially outward and laterally along the circumference on either side of the outer eccentric sleeve or outer housing. --

Please replace the paragraph beginning at line 10 page 9 with the following rewritten paragraph:

24 -- Figure 1 shows an elementary cutaway side elevational view of an apparatus according to an embodiment of the invention utilizing eccentric sleeves in a slightly inclined wellbore having its low-side on the left; --

Please replace the paragraph beginning at line 13 page 9 with the following rewritten paragraph:

25 -- Figure 2 is an elementary side elevational view of the tool of Figure 1, having a weighted side on the right and illustrating the position of the stabilizer shoes; --

Please replace the paragraph beginning at line 17 page 9 with the following rewritten paragraph:

26 -- Figure 4A is an elementary cross section of the tool of Figures 2 and 3 taken at 4A-4A in Figures 2 and 3; --

Please add the following paragraph beginning at line 19 page 9:

27 -- Figure 4B is an elementary cross section of the tool of Figures 2 and 3 taken at 4B-4B in Figures 2 and 3; --

Please replace the paragraph beginning at line 4 page 10 with the following rewritten paragraph:

28
-- Figure 6 is a tool according to another embodiment of the present invention utilizing an eccentric sleeve and a concentric sleeve; --

Please replace the paragraph beginning at line 11 page 10 with the following rewritten paragraph:

29
-- Figure 9 is an elementary cross section of the device, showing the fluid pressure signaling means, taken at 8A-8A in Figure 8; --

Please delete the two line paragraph "Figure 12C is a suggested diagrammatic Bottom Hole Assembly used for up/down and left/right correction" beginning at line 22 page 10.

Please replace the paragraph beginning at line 4 page 11 with the following rewritten paragraph:

30
-- Figure 14 is a schematic of a device according to a preferred embodiment of the invention and containing a sensor. --

Please add the following paragraphs following the word "sensor" at line 5 page 11 and immediately before the heading "Detailed Description of the Invention" at line 6 page 11:

-- Figure 15 is an elementary cross section of the tool of Figures 1 and 6 taken at 15A – 15A in Figures 1 and 6;

Figure 16 is an elementary cross section of the tool of Figure 6 taken at 16A – 16A on Figure 6;

31
Figures 17 are conceptual drawings showing how the upper and lower inner sleeve portion interact with the inner sleeve to arrive at bit offset and bit point. Figure 17A shows the instant

device with two eccentric sleeves; whereas, Figures 17B and 17C show the device with one concentric sleeve and one eccentric sleeve; and

11
(undl)
Figures 18 are simplified diagrams distinguishing between bit offset and bit point. Figure 18A shows bit offset and Figure 18B shows bit point. --

Please replace the paragraph beginning at line 10 page 14 with the following rewritten paragraph:

12
-- The inner sleeve 12 of the example has two parts, an upper part 12a and a lower part 12d. In the device 10 of Figure 1, both the upper part 12a and the lower part 12d have an eccentric bore for receiving the mandrel 11. The upper part 12a is located close to the top end of the device 10 and the lower part 12d is located towards the lower part of the device 10. The upper and lower parts of the inner sleeve are spaced apart from one another along the length of the mandrel 11. --

Please replace the paragraph beginning at line 16 page 14 with the following rewritten paragraph:

13
-- An essentially tubular housing, which will be referred to as outer housing 13 completes the device 10 as shown in the Example of Figure 1. In the example of Figure 1, the outer housing 13 houses the middle part 11a of the mandrel 11. The upper 12a and lower 12d parts of the inner sleeve are located at the upper and lower ends of the housing 13 respectively, such that the housing 13 only covers a portion of each of the upper and lower parts of the inner sleeve 12a, 12d. --

Please replace the paragraph beginning at line 1 page 15 with the following rewritten paragraph:

A14 -- The pregnant portion 20, of the outer housing forms the heavy side of the outer housing and is manufactured as a part of the outer housing. The outer housing 13 is freely rotatable under gravity such that the pregnant portion 20, will always seek the low side of the wellbore. In operation, the position of the inner sleeves is set with respect to the position of the pregnant portion 20 of the outer housing. Therefore, the inner sleeve 11 is moveable with respect to the outer housing. --

Please replace the paragraph beginning at line 7 page 15 with the following rewritten paragraph:

A15 -- Figures 2 and 3 are external views of the device 10. The device is shown without upper adapter sub 4 or drill bit 7. The upper and lower parts 11b and 11c of the mandrel are respectively located at the top and bottom of the device 10. Adjacent the upper and lower parts 11b and 11c of the mandrel 11 are located the upper and lower parts 12a and 12d of the inner sleeve. Viewed from the outside, the outer housing 13 is located between the upper 12a and lower 12d parts of the inner sleeve. As explained with reference to Figure 1, the upper and lower parts of the inner sleeve 12 are partially located within the housing 13. The position of the pregnant portion 20 of housing 13 is shown in outline. --

Please replace the paragraph beginning at line 16 page 15 with the following rewritten paragraph:

A16 -- Stabiliser shoes 21 are located on the outside of housing 13. In this particular example, three stabiliser shoes are located around the circumference of the housing 13. The shoes are elongate and are aligned parallel with the rotation axis of the device 10. The shoes 21 are positioned at 90° intervals from one another. As there are only three shoes, they do not extend around the whole circumference of the outer housing. The shoes 21 are arranged so that there is a first shoe 180° away from the weighted portion, with two shoes positioned on either side of the first shoe. The shoes 21 serve to counter any reactionary rotation on the part of

the outer housing caused by bearing friction between the rotating mandrel, 11, and the inner sleeve, 12, and to center the housing 13, within the borehole 2. --

A16
(cont'd)

Please replace the paragraph beginning at line 20 page 16 with the following rewritten paragraph:

-- The bearings between the inner rotatable mandrel and the inner sleeve, 12, pose a number of interesting problems. If the tool is used in conventional drilling, the inner mandrel must be capable of turning at speeds of up to 250 RPM within the inner sleeve. If the tool is used with downhole motors, the bearing speed will depend on the position of the downhole motor with respect to the tool, but may be substantially higher than the 250 RPM used in normal drilling. The downhole motor may be placed at either end of the tool. If the motor is placed next to the bit, then the rotational bearing speed will be zero. If the tool is placed between the downhole motor and the bit, the rotational speed will be the same as that of the output shaft of the downhole motor. This speed can be higher than 250 RPM, which is normally regarded as the maximum RPM encountered in conventional rotary drilling. --

A17

Please replace the paragraph beginning at line 15 page 17 with the following rewritten paragraph:

-- The rotation between the outer housing, 13, and the inner sleeve, 12, is controlled from the surface and is an 'on demand' occurrence. Thus, these bearing surfaces need not take high continuous rotation speeds and standard sealed bearings may be used. --

A18

Please replace the paragraph beginning at line 19 page 17 with the following rewritten paragraph:

-- Figure 4A shows a cross section of the tool 10 through line 4A-4A of Figure 3. In Figure 4A, the pregnant portion 20 of the outer housing 13 locates itself at the low side of the

A19

wellbore 2. The stabiliser shoes 21 located on the circumference of the outer housing are arranged such that the middle shoe is located against the high side of the wellbore 2 with the other two shoes located on the right and left sides of the wellbore 2. The inner sleeve 12 is located within the bore of the housing 13. Previously, the inner sleeve 12 has been described in terms of two parts, an upper 12a and a lower part 12d. Figure 4 just shows the upper part 12a of the sleeve. However, it will be appreciated by those skilled in the art that the lower part 12d of the sleeve 12 could also be used in this cross section. The inner sleeve 12 is eccentrically bored. The mandrel 11, or more correctly, the central part of the mandrel 11a is located within the bore of the inner sleeve 12. The inner sleeve 12 can be rotated with respect to the pregnant part 20 of the outer housing 13 thus changing the force on the mandrel 11. --

A19
(amended)

Please replace the paragraph beginning at line 3 page 18 with the following rewritten paragraph:

-- Figure 4B shows a cross section through line 4B-4B of Figure 3. In this part of the tool, there is no outer housing 13 or inner sleeve 12. The figure just shows the mandrel 11, with its concentric bore. Three secondary stabiliser shoes 14 are located symmetrically about the mandrel 11. --

A20

Please replace the paragraph beginning at line 23 page 18 with the following rewritten paragraph:

-- The inner sleeve 12 has an upper portion 12a and a lower portion 12d. In this specific example, both portions are moved together. Both portions are drawn with an inclined line which shows the position of the wide side of the inner sleeve 12. This line is a result of the internal cam like form of the inner sleeve. The inner sleeve, of necessity has a wider side and a narrower side. --

A21

Please replace the paragraph beginning at line 1 page 19 with the following rewritten paragraph:

A22
-- For the sake of clarification, whenever the radial placement of the wider part of the inner sleeve is in a certain attitude with respect to the borehole, forces generated by the inner sleeve section will deviate the borehole in a vector at 180 degrees relative to the radial position of the wider section. --

Please replace the paragraph beginning at line 5 page 19 with the following rewritten paragraph:

A23
-- The widest part of the inner sleeve which is closest to the outer housing 13 (as drawn) defines the position of the bias of the inner sleeve. --

Please replace the paragraph beginning at line 25 page 19 with the following rewritten paragraph:

A24
-- Figure 6 shows a further embodiment of the present invention. To avoid unnecessary repetition, similar reference numerals have been used as for Figure 1. The construction of the mandrel 11 and the outer housing 13 are identical to those described for Figure 1. However, the upper part of the inner sleeve differs from that shown in Figure 1 in that the upper part of the inner sleeve 12c is concentrically bored. This combination of a concentric upper sleeve, 12c, and an eccentric lower sleeve, 12d, allows more control over the drilling direction, and has substantial arrangement with respect to the drilling mechanics. Further, this relatively simple arrangement whereby only movement of the upper sleeve is required is particularly advantageous. This so-called "point-the-bit" arrangement can also be achieved if the lower sleeve is concentric and the upper sleeve is eccentric. --

Please replace the paragraph beginning at line 8 page 20 with the following rewritten paragraph:

A25
-- The forces which are created in a "point-the-bit" scenario may differ from those created when two eccentric sleeve portions are provided. (See Figure 1.) In a configuration comprising an eccentric sleeve portion and a concentric sleeve portion, the net effect is to tilt

A25
(contd)

the bit off the axis and thus give some degree of tilt to the bit cutting structure. Such an arrangement would give considerable advantages when drilling the wellbore and may result in a cleaner profile to the wellbore, a desirable state of affairs particularly when drilling extended reach well profiles. --

Please replace the paragraph beginning at line 15 page 20 with the following rewritten paragraph:

A26

-- Figures 17A and 17C respectively show the conceptual difference between the arrangement of the upper inner sleeve portion, 12a, and the lower inner sleeve portion, 12d, (both eccentric) shown in Figure 1 and the arrangement of the upper inner sleeve portion, 12c, and the lower inner sleeve portion, 12d, shown in Figure 6 (one concentric -- one eccentric). As the previous paragraph implies either one of the inner sleeve portions may be concentric or eccentric. Figures 18 show how the forces operate within the wellbore. Two eccentric sleeve offset the bit (Figure 18A); whereas, one eccentric sleeve and one concentric sleeve point the bit (Figure 18B). --

Please replace the paragraph beginning at line 20 page 20 with the following rewritten paragraph:

A27)

-- The pregnant portion 20 of the outer housing 13 provides the reference point or "earthing point" against which the bit bias is referenced. The actual bias forces are applied to the appropriate side of the wellbore through one of the stabiliser shoes 21. In use, the mandrel of the tool would be rotating. It is important that rotation of the mandrel 11 does not cause the outer housing 13 to rotate. Therefore, it is important that the rotational torque transferred to the outer housing from the rotating mandrel 11 does not exceed the self-righting torque mass of the outer housing 13 due to gravity. If the outer housing 13 turns away from the reference on the low side of the hole, the bit bias will not be correct and the directional qualities of the

device will fail. Therefore, it may be necessary to use different speeds for rotating of the mandrel 11 in order to overcome the mass torque limitations of the outer housing 13. --

A27
(cont'd)

Please replace the paragraph beginning at line 25 page 21 with the following rewritten paragraph:

-- It should be noted that the inner sleeve can be manufactured with varying degrees of eccentricity or offset from the wellbore center-axis. The required eccentricity would depend on the formation, the diameter of the wellbore, speed of drilling, type of drilling, maximum projected course alternation of the wellbore and the like. The vector interaction of the shoe with the wellbore wall is selectively controlled by the rotation of the inner sleeve; thus, the magnitude of the offset force is dictated by the ratio of the inner sleeve's eccentricity. A smaller ratio being equal to a smaller vector force and a larger ratio being equal to a larger vector force. The offset can vary from tenths of an inch [millimeters] up to inches [centimeters], and ideally, should be field replaceable and adjustable. The larger the offset, the sharper the change in wellbore direction and the higher the load on the internal bearings. In drilling a straight wellbore the eccentricity offset should be less than about 1/2-inch [1.27 cm]. --

A27

Please replace the paragraph beginning at line 11 page 23 with the following rewritten paragraph:

-- Figure 7B shows a variation on the arrangement of Figure 7A. Here, a rack is provided around the inner circumference of the outer housing 13. The weighted side of inner sleeve 12 is provided with pinion 25. Movement of the pinion 25 effects movement of the outer housing 13 in a similar manner to that which was described with reference to Figure 7A. --

A27

Please replace the paragraph beginning at line 3 page 24 with the following rewritten paragraph:

-- The preferred technique will be described for the motion of a single part of the inner sleeve which is illustrated in Figures 8 and 9. A passageway, 17, is bored in the rotating mandrel which allows some drilling fluid to exit the bore via additional offset passages bored in the inner sleeve, 16, and in the outer housing, 15. The passageway, 17, in the rotatable mandrel terminates in bit-jet/orifice, 19, combination. The bit-jet is capable of taking the pressure drop without damage. A groove, 18, is cut in the outer surface of the inner sleeve 12 which allows the drilling fluid to exit the bore even if the passages, 15,16, are not aligned. When the passages, 15,16, are aligned, the rate of drilling fluid leaving the bore is higher than the rate when the passages are not aligned. Thus, a pressure difference signal would occur at the surface whenever the inner sleeve is toggled or switched from one position to another. --

Please replace the paragraph beginning at line 12 page 26 with the following rewritten paragraph:

-- A communications device comprising a magnet 28 is attached to said rotating member 11. The magnet is located in a pocket on said rotating member 11. This specific embodiment uses the magnet as an emitter. However, it will be appreciated by those skilled in the art that the magnet could be replaced by any type of emitting sensor. --

Please replace the paragraph beginning at line 16 page 26 with the following rewritten paragraph:

-- The outer housing 13 contains instrument barrels 6. The instrument barrels 6 are provided with sensing means. During drilling of the well bore 2, the heavy portion of the outer housing seeks the low side of the well bore and the position of the outer housing remains relatively fixed with respect to the well bore. The mandrel 11 and magnet 4 rotate relative to the outer housing 13. Lines of flux 5 radiate from the magnet 4 with sufficient magnitude to overcome the Earth's ambient field. The flux lines 5 extend radially beyond the instrument

barrel 6 such that sensors within the instrument barrel 6 can detect the intensity of the emitted magnetic field. --

A32
(1.2-14)

Please replace the paragraph beginning at line 24 page 26 with the following rewritten paragraph:

-- When the magnet 28 is rotated such that it is closest to the sensors in the instrument barrel 6, the sensors detect a maximum amplitude in the magnetic field. In a similar manner, when the magnet 28 is furthest from the instrument barrel 6, a minimum in the amplitude of the magnetic field will be detected. The field detected by the sensors may be sinusoidal if it is possible to sense the radiated magnetic field at all times when the mandrel 11 is rotating. In order to accomplish this, at least a part and possibly the entire drill string mandrel will have to be constructed from austenitic type materials, or materials with similar non-magnetic properties. --

A33

Please replace the paragraph beginning at line 19 page 27 with the following rewritten paragraph:

-- Inevitably, there will be material between the magnetic sensor in the instrument barrel 6 and the magnet 28 located on the rotating member. This intervening material should, as far as possible, be magnetically transparent. In other words, the magnetic field should pass through this material without becoming deflected or distorted. Materials which exhibit these properties include austenitic stainless steels and other non-ferrous material. --

A34

Please replace the paragraph beginning at line 25 page 27 with the following rewritten paragraph:

-- Figure 11 shows an embodiment of the present invention. As in Figure 1, the downhole tool is connected to a drill bit and an adapter sub 30. In Figure 11, the lower part of the mandrel 11 is connected to the drill bit 7 by adapter sub 3. --

A35

Please replace the paragraph beginning at line 1 page 28 with the following rewritten paragraph:

A36 -- The upper adapter sub 30 allows the tool 10 to be connected to surveying tools 29 and drill collars 8. The drill collars are attached to drill string 9. Additional stabilisers (not shown) will be added as per standard drilling procedures. --

Please replace the paragraph beginning at line 11 page 28 with the following rewritten paragraph:

A37 -- As previously explained, the tool can provide directional control both up and down and left to right. For up/down control the offset provided by at least one of the parts of the direction control means is provided either next to the weighted side of the housing or opposite the position of the weighted side of the housing. Figure 12B is a diagrammatic representation of a device used to control up/down only. Here the bit, 7, is followed by a near bit stabilizer, 24, with the up/down tool 10, placed at distance "l" from the bit. This distance would range between 15 feet [4.57 m] and 30 feet [9.14 m]. (the use of the British System of units is the standard of the drilling industry; hence, this description uses the industry standard.) --

Please replace the paragraph beginning at line 1 page 29 with the following rewritten paragraph:

A38 -- To avoid unnecessary repetition, where appropriate, like reference numerals will be used to denote like features. Comparing Figure 13 with the cross-sections of Figure 7A and 7B, it can be seen that a weighted housing 13 is provided which surrounds mandrel 11a. Mandrel 11a is located within sleeve 12. Mandrel 11a is free to move within sleeve 12. Sleeve 12 is connected to housing 13 via three linear actuators, 31, 33 and 35. The three linear actuators 31, 33 and 35 are disposed in a plane about said mandrel and are offset from one another by 120°. Each of the linear actuators is configured such that it can extend or contract as required. --